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Methods of Coaling Locomotives

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METHODS OF COALING LOCOMOTIVES

BY

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THESIS FOR DEGREE OF BACHELOR OF SCIENCE
IN CIVIL ENGINEERING

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Lawrence Gilbert Parker

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OF Bachelor of Science in Civil Engineering

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Methods of Coaling Locomotives.

The object of this thesis is to classify and describe the various methods of coaling locomotives. The writer has made free use of Walter G. Berg's article on "Coaling Stations for Locomotives" in Railroad Gazette, Vol. 24, pp. 94-96, and 132-133, and also of the report of the Committee of the American Railway Master Mechanics' Association headed "Coal Delivery to Locomotives" in Engineering News, Vol. 18, pp. 216-219.

The design of a coaling station depends largely upon the individual views of the railroad officials, as well as upon the topographical features of the locality, the amount of coal to be handled in a given time, the kind of cars in which the coal is to be delivered, and whether the coal is to be supplied directly from the cars or to be taken from storage pile or bin which has been provided for irregularities

in the supply, and also whether or not the station is a place where rapid coaling is necessary.

The cost of operation as well as the amount of breakage of coal is much reduced by having a system in which the number of handlings is kept as small as possible. Every station should be provided with a means for determining the amount of coal delivered to an engine. Scales may be used for this purpose or the amount may be determined from the capacity of buckets, dump cars or pockets.

The explanation of the different methods in general use will be taken up in the order indicated in the following classification, made according to the methods of handling the coal:

I. Shoveling from Car to Tender.

II. Coaling from Platforms.

A. Delivery of Coal to Platform.

a. Handling by Horse and Cart from Pile on Ground.

b. Shoveling from Cars on Coaling Track.

c. Shoveling from Cars on Raised Track at Rear of Platform and on Level with It.

d. Dumping from Cars on Trestle 8 to 10 Feet above Platform.

B. Delivery of Coal from Platform to Locomotives.

a. Shoveling Direct into Tender.

b. Dumping from Small Iron Hand-carts or Buckets on Wheels.

c. Dumping from Fixed Tipping Boxes along the Face of the Platform.

d. Dumping from Small Trolley Cars.

1. Cars on Tracks Running Perpendicular to the Face of the Platform.

2. Cars on Track Running Parallel with the Face of the Platform.

e. Dumping from Pocket Cars.

III. Handling with Crane and Buckets.

A. Traveling Crane.

B. Jib Crane.

IV. Dumping from Chutes at High Elevations.

A. Methods of Elevating the Coal.

a. By Horse and Cart from Pile on Ground.

b. By Locomotive on Long Incline.

c. By Stationary Engine with Cable.

1. Standard Gage Cars on Short Incline.

2. Small Dump Cars on Short Incline.

d. By Direct Hoisting Apparatus.

1. Small Dump Cars on Platform Elevator.

2. Standard Gage Cars on Large Platform Elevator.

c. By Trough or Bucket Conveyors.

1. Trough Conveyors.

2. Bucket Conveyors.

B. Methods of Delivery.

a. From Overhead Bridges or Bins.

1. Cars on Bridge.

2. Bins.

b. From Pockets or Bins at Side of Track.

1. Pockets.

2. Bins.

c. By Combination of Platform and Bin.

I. Shoveling from Car to Tender.

Shoveling directly from car to tender is a primitive method which requires no special structures or appliances. It is probably the cheapest method for coaling where the output is very small, but it requires a great deal of time and should be used only in case of necessity or temporarily until permanent stations can be established. The cost of coaling for coal in a good condition varies from 8 to 15 cents; and for coal that is badly frozen probably from 20 to 30 cents per ton.

II. Coaling from Platforms.

A. Delivery of Coal to Platforms. The cost of coaling from platforms on level with the top of the tender depends a great deal upon the method of delivering the coal on the platforms, of which there are four:

a. Hauling coal by horse and cart from a pile on the ground is a simple method of delivering coal to the platform which has the advantage of requiring less extension platforms than other methods, since the coal may be stored on the ground instead of on the platform. The delivery to the platform by this method costs from 7 to 15 cents per ton in addition to the cost of unloading the coal into the storage piles, which is from 7 to 15 cents.

b. Small platforms are sometimes placed at the side of a switch or passing track, upon which coal is shoveled from cars on the coaling track. This form of station can be economically used in places

where locomotives are only occasionally required to take coal. It has the advantage over the method of shoveling directly from the car to the tender that the cars in which the coal is delivered may be emptied and put into service again and also that a clear track is left for switching purposes. In loading the tender, the coal is shoveled from the platform which can be more easily and quickly done than from a car. The cost of shoveling from cars to platform varies from 7 to 15 cents per ton.

c. In localities where natural facilities make it possible or in crowded yards where the length of approach is limited so that a high elevation can not be reached by cars on an incline having a reasonable gradient, it is often convenient to run cars onto a track at the rear of a platform and level with it. The coal is then shoveled from these cars to the platform by hand. The gradient commonly used is from 3½ to 5 ft. in 100 ft.; but it may be necessary to make it as much as 8 ft. or

over 10 ft. in some cases. Where the steeper grades are used empty cars are placed between the loaded cars and the locomotive so that the latter need not run up the incline. Vertical curves are required at both ends of the incline to prevent injury to the cars. The cost of delivering coal to the platform by this method, under favorable conditions, varies from 6 to 12 cents per ton.

d. An economical method often used for delivering coal to platforms where large quantities are used, is that by which the coal is dumped from cars on a trestle set on the platform at some distance back from the face, the height of the raised delivery track being from 8 to 10 feet above the platform. The approach is required to be longer for this method than for the methods previously discussed, but where a considerable quantity of coal is used and the cars are unloaded by dumping, the cost of operation is merely nominal since the cost of maintenance per ton of coal is not large, especially

where the approach is built upon elevated ground.

B. Delivery of Coal from Platform to Locomotive. One of the most important points in connection with a coaling station is the method by which the coal is delivered to the tenders. The following methods are in common use:

a. Shoveling directly from platform to tender is the most primitive method and requires considerable time unless a large number of men is employed, in which case the cost runs up quite high owing to the loss of time of the men between coalings. This method should be used only at places where the output is small or where the engine crew has plenty of time to do the coaling. This method is used when coal is delivered to the platform as explained in A, b, and often when delivered as explained in A, a. One man can shovel from 20 to 30 tons from a platform per day of ten hours; and the cost of delivery varies from 6 to 12 cents per ton. The American Master Mechanics

Association in its report for 1887, states that the cost of shoveling from a platform at the level of the foot plate, delivering 30 tons per day, including measuring but exclusive of delivery of the coal onto the platform, was 10 cents per ton; while on a Canadian road the cost of shoveling from car to platform and from platform to tender ran as high as 34 cents per ton where the output was small (42-55 tons per week) and the coal was badly frozen. The same report also states that it costs from 13 to 15 cents per ton at a station on the Lehigh Valley Railroad to shovel from a car to the platform and thence to the tender.

6. A more efficient method than the one just described is that in which small iron hand-carts are used. These carts are usually filled by the regular station helps from the storage pile at the rear of the platform. The carts hold from one half to one ton of coal; and are made either with or without projecting spouts at the front end. In the former case the spout directs the coal into the tender; and in the second case the coal is dumped upon a

stationary apron along the face of the platform, and the carts are less cumbersome than with the spouts. If the aprons are used, locomotives are required to stop at certain places along the platform and the coal must be brought to these places. This objection is not a serious one; and may be overcome by having aprons which move along an iron rod parallel to the face of the platform. The time required for coaling by this method is from 3 to 5 minutes which is much less than that required for shoveling from platform to tender. The report of the American Master Mechanics' Association of 1887 states that, at Lehighton, Pa., on the Lehigh Valley Railroad, the cost of dumping from cars on elevated track into hand carts and from carts to locomotive varies from 5 to 10 cents. The report of 1901 gives the cost by the same method of 4 cents per ton on the Mobile and Ohio R.R.

c. Fixed tipping boxes having capacities varying from 3 to 6 tons placed along the face of a platform may be economically used for large or small outputs. Locomotives

can be coaled in a few seconds by this method, since the whole charge can be obtained from a single box. These boxes can be used quite advantageously where the coal is delivered by horse and cart. The usual method of filling the boxes, however, is (1) by dumping from cars on elevated trestle, (2) by shoveling direct from cars on track back of the boxes, or (3) from a storage pile on the rear of the platform. In shoveling direct from the car, only one handling of the coal is required but more or less shifting of cars is required in order that they may be placed opposite the proper boxes. The cost of merely delivering the coal by this method is perhaps from one to two cents per ton. When it is necessary to fill the boxes from a storage pile on the rear of the platform, two extra handlings of the coal will be required which will make the cost run up to 15 or 20 cents per ton.

d. An improvement over the method just described, and the one used in most cases where coal is delivered from platforms, is that in which the coal is dumped from

small trolley cars which run on tracks either perpendicular or parallel with the face of the platform and which are usually loaded at the rear of the platform from standard gage dump cars on elevated track or from a storage pile.

In the case in which the cars discharge from tracks perpendicular to the face of the platform, the locomotive is required to stop at fixed points along the platform, and special cars must be provided for each track, each car being used only on its own track. The discharge ends of the tracks are sometimes provided with stops by means of which the impetus of the car is utilized in automatically tipping and dumping it. The ends of the transverse tracks are sometimes hinged and kept in a vertical position when not in use. The hinged portion is operated like a drawbridge, and in coaling a locomotive, a car is run out upon it and is dumped by a trap door in the bottom of the car.

The platform having a track parallel

to its face is a modification of the above case in which the longitudinal track intersects the transverse tracks at the face. A turntable, which may be provided with scales, is placed at the track intersections for transferring the cars. When longitudinal tracks are used locomotives can receive their coal from any point along the face of the platform and any car on the platform can be brought to that point to be discharged.

The cars are either furnished with hinged doors at the ends and discharge into fixed iron aprons or have long projecting ends which serve as aprons. The former when on a transverse track discharge by simply turning on a horizontal axis, but when on a longitudinal track are usually made to rotate about a vertical axis and then turn upon a horizontal axis. The latter is used only on transverse tracks and is described in the report of the Master Mechanics' Association as "simply a dump car (with one truck turning on its short axis. One end of the car is

open and the truck is placed under the opposite end. The inside dimensions are 10 ft. 8 in. long by 5 ft. 10 in. wide by 1 ft. 10 in. high. This car, when loaded with 3 tons of coal, is operated by one man."
The cost of coaling from trolley cars, as stated by the same report, on the Connecticut River Ry., delivering 45 tons per day, was 14 cents per ton; on the New York, Chicago & St. Louis R.R. the rate was 8 cents per ton for 74 tons per day; and on the Northern Central Ry. with cars having extended ends, described above, the average cost per ton, for January, February, and March 1887, was 4.6 cents, employing two men and delivering 57½ tons per 24 hours.

c. In dumping from pocket cars, a trestle takes the place of the platform required by the methods previously described. In the Master Mechanics' report for 1887, there is described a side dump coal car and oscillating apron designed by D. S. Dockstader "to deliver coal direct from car to tender without use of shovel, and therefore at minimum expense.

The floor of the car inclines upward from the side sills to the center at so great an angle that, when one of the side flap doors (hung from top rail) has its latch released, the coal will freely slide out. There are five compartments and five doors on each side, so that each of the ten pockets in a 30 ft. 20-ton car holds two tons. A ramp and trestle 11 ft. 4 in. high are needed to lift the coal car above the level of the tender, and vertical posts carried up to both sides of the horizontal part of this trestle support metal hinges upon which are swung aprons of the width of the width of the car pockets. Under normal conditions, the apron stands upright and in line with the posts thus clearing both tender and cars, but the pulling on a short rope swings the apron into position for acting as a guide, and the pulling of a handle locks it there, after which the latch securing the lower side of the flap door on the car is released.

The first cost of the plant and the daily outlay for labor are very light when this system is used, its chief defect (aside from the large yard space taken by the three parallel tracks) being the comparative uselessness of the cars for ordinary freight service on return trips to mines, so that the cars would probably only earn revenue on half of their total mileage - if hauling company's fuel can, by stretch of language be said to be revenue earning service."

III. Handling with Crane and Buckets.

Coaling is often done by either traveling or jib cranes, the latter being the more common.

A. Traveling Cranes. Traveling cranes are designed to span several tracks and may consist of an overhead girder traveling along trestles 25 or 30 ft. high, or at each end of the girder, or the crane may be carried by long vertical legs which move along tracks at the ground level. These cranes are electrically or steam operated and handle tipping or bottom dumping buckets which have a capacity of 2 to 4 tons. Traveling cranes are not much used and should be employed only when the coal must necessarily be shoveled. The first cost of this system is small, since the ground may be used for storage. A traveling crane on trestles is in use at Columbus, Ohio, by P.C.& St.L. Ry. This crane is operated by steam and is reported to deliver coal to locomotives at 6.8 to 9.1 cents per ton, including interest on first

cost and cost of repairs, the average time for coaling being 6 minutes.

B. Jib Cranes. Jib cranes are operated either by hand or with compressed air. Those using compressed air receive the air from the locomotive air-pump. The jib crane is quite often used where the output is small, in which case the coal is shoveled from cars or storage pile into one or two ton tipping or bottom-dumping buckets and then is lifted by the crane, swung over the tender, and dumped. The cost of coaling by this method varies from 3 to 20 cents per ton. The Minnesota & International Ry. reports the cost at 3 to 5 cents, the Chicago, Cincinatti, Cleveland, & St. Louis Ry. at 6 cents, and the Chicago & Western Michigan Ry. at 17 to 20 cents per ton.

IV. Dumping from Chutes at High Elevations.

Dumping from chutes or pockets at high elevations is the most common method of delivering coal to locomotives, since it has the advantage of economy as well as rapid delivery. The coal is delivered to the tenders from side of track or from overhead bridge spanning the tracks.

A. Methods of Elevating the Coal. There are five general methods of elevating the coal. The cost of elevating by these methods has not been separated from the cost of delivery; but as the cost of delivery is usually only a fraction of a cent and does not vary a great deal, the cost of handling by the different methods will be considered only under this head.

a. The method of hauling the coal up an incline by horse and cart is practically the same as for platforms except that a higher elevation must be attained in order that the coal may be dumped directly into pockets. The cost is also about the same. (see II, A, a, p. 6).

b. The method of elevating the coal by a locomotive on an inclined trestle is practically the same as that for platforms, except that a longer incline is required, (see II, A, c&d, pp. 7&8). Where the coal is discharged by shoveling, the trestle need have only sufficient elevation to bring the top of the cars level with the top of the pockets or chutes; but where the coal is dumped from ~~the~~ bottom or side dump cars the trestle must have such elevation as will permit the cars to discharge directly into the chutes or upon platforms, level with the top of the chutes, from which the chutes are filled by shoveling. Instead of discharging the coal into the chutes, it is sometimes diverted into storage bins beneath the chutes to be used in case of shortage in the regular supply. The cost of shoveling from car to chute varies from 5 to 11 cents per ton, and when the coal is dumped from the cars into the chutes the cost, as shown by reports, varies from ½ to 12 cents, 3 to 5 cents being the more common.

When the coal is dumped upon a platform and shoveled from the platform to the chutes, the cost under favorable conditions is from 4 to 8 cents per ton.

c. Stationary engines with cables are used to draw standard gage cars up where the inclines are required to be short and steep on account of limited yard space. The cost by this method has been reported to be 2 cents per ton where the cars were hoisted by a gasoline engine.

Stationary engines with cables are also used to draw small cars, which have first been filled from standard gage cars on low dumping trestle, up steep inclines to be dumped into storage bins or chutes. This method is in use on the Great Northern Ry. and costs about 3½ cents per ton. It is not economical unless large quantities of coal are handled, in which case only one or two men are required to operate it.

d. A direct hoisting apparatus is often used to elevate the coal from storage bins and from storage piles upon the ground. Whether the storage is in bins or upon

the ground, the coal must be shoveled by hand or by steam shovel into buckets or small trolley cars; the cars then being run upon a small platform elevator, operated by stationary engine and cable, electric motor, or compressed air, and hoisted to a platform having sufficient height to permit of direct dumping from cars into chutes. A locomotive hoist, designed by J. B. Collins, has been successfully used at a number of stations on the Pennsylvania Railroad. It consists of a 29 ft. tower at one side of the coaling track and a dumping trestle at a convenient distance in the rear, 30 to 40 feet from coaling track, and having an elevation of about 8½ feet above the ground. Small end-dumping cars of special design are loaded at the dumping trestle, either from pile beneath the trestle or by dumping from the cars on the trestle, and run across a scale to a hoisting cage in the tower. The cage is operated by a chain or cable which passes over a properly arranged system of pulleys. The end of the chain passes through a pulley in the center of the track

at 75 to 100 feet from the tower and, when a locomotive desires to take coal, is attached to the locomotive or tender to draw the small car high enough to discharge its coal into an apron which delivers the coal to the tender. The cost of elevating the coal by direct hoist when the shoveling is done by hand is from 7 to 9 cents and when done by steam shovel is from 5 to 7 cents per ton in addition to the cost of delivery of the coal into storage.

A modification of the above method has recently been constructed on the Atchison, Topeka, & St. Fe Ry. It consists of a large platform elevator operated by gasoline engine and cable, and is capable of hoisting standard gage cars high enough to permit of their dumping directly into the bins or chutes. The advantages of this method are that no yard space is taken up by a long incline and it does away with unnecessary handling of the coal. The cost of handling coal by this method has not been obtained.

C. Mechanical conveyors are very economically used where coal is delivered

to station in hopper bottom cars, since shoveling is avoided and yard space is not taken up by a long incline. On account of the small space occupied by the stations at which these methods are used, they are often preferred where a part or even all of the coal must be shoveled. These conveyors have for their chief advantage the ability of rapidly handling large quantities of coal. Trough conveyors consist of continuous link belts to which are attached flat disks or plates that move along troughs pushing the coal before them. A coaling station equipped with this system is provided with a receiving pit beneath the receiving tracks into which the coal is dumped from hopper bottom cars. Provision is made at these stations for handling the coal which is delivered in dongola or box cars. This coal however is handled at an increased cost since it must be shoveled from the cars. The coal in the receiving pit is moved by gravity or by a conveyor to an inclined trough

up which coal is carried to the top of the building. From here it is delivered into pockets or storage bins either by opening gates in the bottom of the trough or by use of spouts; or is delivered by gravity into another trough and then carried to pockets or storage bins. Stations having storage bins beneath the chutes are provided with conveyors beneath the floor of the bins to handle the stored coal thus avoiding hand shoveling. In many of these stations the Dodge Conveyor system has been used in which "the cable chain is composed of wrought iron, having detachable, malleable iron wearing blocks between each link, together with attachment blocks inserted at intervals to which are attached peculiarly curved flights which scrape the coal along the trough". This system has been installed at a large number of stations by the Link Belt Engineering Co. of Philadelphia, Pa. and the Link Belt Machinery Co., of Chicago. The latter company also manufacture the Monobar conveyor, which consists of flights

at each end of which are attached short hinged bars which replace the linked chain that is often used. The cost of handling coal by the trough conveyor can not be definitely stated on account of lack of data, but it seems that it should not be more than 3 or 4 cents, if the system is economically operated, although reports from several stations using the Dodge System state that the cost is from 6 to 7½ cents per ton.

Bucket conveyors consist of a continuous series of buckets having rectangular horizontal sections and are connected at the ends to linked chains or short hinged bars. Coal from road cars is dumped into a receiving pit and is delivered by gravity or trough conveyor into a feeder or elevator shoe which feeds it into buckets that carry it to the top of the bins or chutes. After the coal has been carried to the top of the building, it is distributed either by spouts or in some systems a trip is used which may be set to discharge the buckets at any desired point along the

tops of the chutes. A better understanding of this system may be obtained by consulting the catalogs and pamphlets of the Link Belt Machinery Co. and Fairbanks, Morse & Co., of Chicago and C. W. Hunt Co., of New York. Stations using the Link Belt Company's machinery state a cost of 5 to 8 cents per ton for handling coal, those using the C. W. Hunt Company's machinery report 2 to 4 cents, and Fairbanks, Morse, & Company's, 7 cents per ton. Fairbanks, Morse, & Company's machinery is especially adapted to small stations.

B. Methods of Delivery. Although the methods of delivering coal to locomotives from bins or chutes at high elevations are very numerous, they will be classed in three groups.

a. Coal delivered to locomotives upon two or more parallel tracks is usually dumped from small dump cars on overhead bridge or from bins above the tracks.

The overhead bridge has been the more commonly used for this purpose. The bridge spans the tracks to which

coal is to be delivered and is provided with a track upon which small dump cars are run. Just beneath the bridge there are chutes or pockets provided with aprons which receive coal from the small dump cars through an opening between the rails of the track above and deliver it to the locomotive on the track below. When the chutes are used, the coal is dumped from the cars after the end of the chute has been lowered. These chutes are either placed one above each track or a pair is placed between and above a pair of tracks so that each track may be served by two chutes, one from each side. The pockets usually have the latter arrangement and are built to hold several tons of coal, thus making it possible to coal the locomotive by merely lowering an apron. The small cars may be filled from bins at one side of the coaling tracks or by other arrangements and may be used to measure the coal delivered to the locomotives.

Overhead bins are being used at

stations where mechanical conveyors (see IV, A,e, pp. 24-28) have been installed. The cost of coaling by this arrangement, since it avoids an extra handling of the coal, is less than by that just described; and the coaling may be done much more rapidly, since all of the coal required by a locomotive may be obtained by lowering but one chute. These bins could be supported upon scales to determine the amount of coal delivered to locomotives, although weighing devices have not been much used.

b. Delivery of coal from chutes or bins at the side of the track is probably the most common method in use.

Chutes or pockets are constructed with inclined floors and the front of the pocket is formed by a hinged door. The inclination of the floor of the chutes varies on the different roads from 30° to 45°; flatter slopes of course being required for anthracite than for bituminous coal. In front of the pocket and just outside of the door, there is an apron which, when lowered, serves as a guide to carry the coal to the tender.

When not in use it is held in a vertical position by counter-weights or latches. Sometimes the door at the front of the pocket is omitted, in which case the coal is held back by the apron until it is to be discharged. The pockets vary in capacity from 2 to 7 tons, and the amount of coal received by each locomotive is determined (1) by measurements from graduations at different heights in the pocket, (2) by measurement or weight of coal in small dump cars, if these be used in filling the chute, (3) by having the pocket suspended on scales or weighing dynamometer, or (4) by weighing the tender before and after it has received its coal. The most common types of chutes in use are the Kerr Chute, the Burnett & Clifton Automatic Chute, and the Erie Chute. "The distinguishing characteristics of the Kerr and Clifton chutes are: first, the way in which the aprons are secured by latches or catches; second, the balancing of the aprons; and third, the use of a hinged

or flap door to form the front of the pocket."

Bins instead of chutes are in use at a large number of stations. They vary in capacity from 10 to 200 tons. They have hopper bottoms and at each opening there is a mechanical cut-off for regulating the flow of coal into a balanced apron which carries the coal to the tender and when not in use is held in a vertical position in front of the bin. A station may have one or any number of these bins and is often provided with cinder and sand bins. At some stations these large bins are mounted directly upon weighing apparatus from which the amount of coal taken by a locomotive may be determined. The advantages of this method are the small amount of handling of the coal, thus saving in loss due to breakage; the low cost of delivery; and the rapidity with which the coaling can be done. The bins most commonly used are the Mc Henry, the Hunt Co., the Link Belt Co., and the Fairbanks, Morse, & Co. bins.

c. The Erie road has used a combination of the platform and bin methods at some of its stations. The coal having been dumped into bins from cars on elevated track, it is discharged at the bottom of the bin into small dump cars which discharge by running out upon a hinged track similar to the one described in II, B, d2, p. 13. The coal is handled in this way in order that the amount of coal delivered may be determined by using the cars for measuring the coal, but delivery by this method costs more and requires more time than do the two methods just described

Conclusion.

It may be stated in conclusion that the cheapest method of handling coal where the amount handled per day is small and where the coaling may be leisurely done is to shovel direct from cars or platform or, if locomotives are required to be coaled in less time, crane and buckets may be used on the platform with but small outlay; stations where larger quantities of coal (30 to 50 tons per day) are handled, one of the various methods of mechanical conveyors in connection with chutes or bins may be used quite economically; and at stations where the quantities of coal handled is quite large, probably the most economical method is that by which standard gage cars dump from a high trestle or elevated track directly into chutes or bins from which the coal is delivered by gravity into the tender, or where the ground space is limited, an elevator may be used for lifting small

or standard gage cars to discharge into chutes or bins, but in this case the mechanical conveyor may be operated as economically. If the daily supply of coal for the chutes is taken sometimes from cars and sometimes from storage, the mechanical conveyors are usually the most economical devices to use. A well equipped station should be provided with some means of weighing or measuring the amount of coal delivered to each locomotive. Recent reports of railway associations upon the subject of coaling stations recommend the storage of coal at the stations to provide for uncertainties of transportation, strikes, riots, or other disturbances; and to dispense with the expensive storage of coal in cars near the station or at the terminal; and as coal deteriorates when stored in open piles, closed bins should be used.

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